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sight to promise a very important advance in the power of artillery. The practical difficulties attending the utilization of these results are, however, sufficiently formidable to place, at any rate at present, comparatively narrow limits upon our powers of availing ourselves of the advantages in ballistics which they may present. The strength of the gun-carriages, and the character of the arrangements used for absorbing the force of recoil of the gun, need considerable modifications; greater strength and perfection of manufacture are imperative in the case of the shells to be used with charges of a propelling agent, by the firing of which in the gun they may be submitted to comparatively very severe concussions; the increased friction to which portions of the explosive contents of the shell are exposed by the more violent setting back of the mass may increase the possibility of their accidental ignition before the shell has been projected from the gun; the increase of concussion to which the fuze in the shell is exposed may give rise to a similar risk consequent upon an increased liability to a failure of the mechanical devices which are applied to prevent the igniting arrangement from being set into action prematurely by the shock of the discharge; lastly, the circumstance that the rate of burning of the time-fuze which determines the efficiency of a projected shrapnel shell is materially altered by an increase in the velocity of flight of the shell, also presents a source of difficulty.

One of the first uses for purposes of warfare, to which it was attempted to apply gun-cotton, was as a charge for shells.

The author next again refers to the French melinite, and states that, although the secret of its composition was well kept, it soon transpired that the French authorities were purchasing large quantities of picric acid; and this led to the inference that this substance, known to be explosive, was used in the preparation.

The precise nature of melinite, Sir Frederick continued, appears to be still only known to the French authorities. It is asserted to be a mixture of picric acid with some material imparting to it greater power; but accounts of accidents which have occurred, even quite recently, in the handling of shells charged with that material, appear to show, that, in point of safety or stability, it is decidedly inferior to simple picric acid. Reliable as the latter is in this respect, its employment is, however, not unattended with the difficulties and risks which have to be encountered in the use, in shells, of other especially violent explosives. Future experience in actual warfare can alone determine decisively the relative value of violent explosive agents, and of the comparatively slow explosive, gunpowder, for use in shells; it is certain, however, that the latter still presents distinct advantages in some directions, and that there is no present prospect of its being more than partially superseded as an explosive for shells. Referring to submarine mines and locomotive torpedoes, such as the Whitehead and Brennan torpedoes, Sir Frederick stated that progress recently made in the practical development of explosive agents has not resulted in the provision of a material which equals wet compressed gun-cotton in combining with great destructive power the safety to those who have to deal with these weapons.

The president next proceeded to deal with the question of explosions in mines, dwelling at some length on the use of naked lights and safety-lamps,—a subject upon which he is, as is well known, an authority. The petroleum industry next occupied his attention, the following statistics being given of the product of the United States:—

In 1859, 5,000 barrels (of forty-two American gallons) were produced; in the following year the production increased to 500,000 barrels; while in the next year (1861) it exceeded 2,000,000 barrels, at which figure it remained, with slight fluctuations, until 1865. The supply then continued to increase gradually, until, in 1874, it amounted to nearly 11,000,000 barrels. In 1880 it amounted to over 26,000,000 barrels, and in 1882 it reached 31,000,000. Since then the supply furnished by the United States has fallen somewhat, and last year it amounted to 21,500,000 barrels. In addition to the petroleum raised in Pennsylvania, there is now a very large production in the State of Ohio, which is, however, transported by pipe-lines in great quantities to Chicago, for use as liquid fuel in industrial operations.

The production of crude petroleum in Russia was next referred to in the address. In 1863 the supplies from the Baku district

amounted to 5,018 tons. They increased to somewhat more than double during the succeeding five years. In 1869 and following three years the production reached about 27,000 tons annually, and in 1873 it was about 64,000 tons; three years later, 153,000 tons were produced; and in the following five years there was a steady annual increase, until, in 1882, the production amounted to 677,269 tons; in 1884 it considerably exceeded 1,000,000 tons; and last year it was about 3,300,000 tons. The consumption of crude petroleum as fuel for locomotive purposes has, moreover, now assumed very large proportions in Russia, and many millions of gallons are annually consumed in working the vast system of railways on both sides of the Caspian Sea.

The imported refined petroleum used in this country in lamps for lighting, heating, and cooking, was exclusively American until within the last few years, but a very large proportion of present supplies comes from Russia. The imports of kerosene into London and the chief ports of the United Kingdom during 1889 amounted to 1,116,205 barrels of United States oil, and 771,227 barrels of Russian oil. During the same period the out-turn of mineral oil for use in lamps by the Scottish Shale Oil Companies probably amounted to about 500,000 barrels.

The prospects of less-known or less-worked sources of supply in other parts of the world were next touched upon. The subject led up to some remarks on the discovery and application of natural gas, which, in turn, brought water-gas before the meeting. No address delivered to a scientific body is now complete without some reference to technical education, and Sir Frederick naturally devoted a few paragraphs to that subject. The Imperial Institute also could not with decency have been excluded from an important delivery by its organizing secretary. Sir Frederick, however, with great moderation, confined himself to a few paragraphs on the subject. The address was of great interest, and was listened to by a large audience. It could, of course, have been made doubly instructive had its author dealt with Cordite, among the other explosives upon which he spoke; but this naturally would have been a breach of the conventionalities, for which, no doubt, Sir Frederick was sufficiently thankful.

HEALTH MATTERS.

Danger in Exercise.

THE *Providence Journal* quotes Dr. Patton, chief surgeon of the National Soldiers' Home at Dayton, O., as saying, in an interview he had in Pittsburgh, that, of the five thousand soldiers in the Dayton home, "fully 80 per cent are suffering from heart-disease in one form or another, due to the forced physical exertion of the campaigns;" and he made the prediction, according to the *Medical and Surgical Reporter*, that as large a percentage of the athletes of to-day will be found twenty-five years from now to be victims of heart-disease, resulting from the muscular strains that they force themselves to undergo. As for the likelihood of exercise to prolong life, it may be said, that, according to the statistics of M. de Solaville, there are more people living in France to-day who have passed the age of sixty than there are in England, the home of athletic sports; and there is probably no nation in Europe more adverse to muscular cultivation for its own sake than the French. Great athletes die young; and a mortality list of Oxford rowing-men, published a few years ago, showed that a comparatively small percentage of them lived out the allotted lifetime. Dr. Jastrow has demonstrated in some very elaborate statistics that men of thought live, on an average, three years and a half longer than men in the ordinary vocations of life.

Decrease of Tuberculosis in England.

There is an instructive lesson in the English mortality returns from tuberculosis for the last forty years, says the *Medical and Surgical Reporter*. In the ten years from 1851 to 1860 the number of deaths from tuberculosis in persons from 15 to 45 years of age amounted to 3,943 in every million; from 1861 to 1870 it had fallen to 3,711; from 1871 to 1880 it was 3,194; and from 1881 to 1887 it did not exceed 2,666. The decreased rate is more marked in the female than in the male sex.